Test Report

T004 (EN ISO/IEC 17025)

INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 15 C AND ISED CANADA REQUIREMENTS

Equipment Under Test:	Varjo VR-3 Mixed Reality Headset
Model/type:	PMN: VR-3 HVIN: HS-6
Manufacturer:	Varjo Technologies Oy Vuorikatu 20 FI-00100 Helsinki Finland
Customer:	Varjo Technologies Oy Vuorikatu 20 FI-00100 Helsinki Finland
FCC Rule Part:	15.247
IC Rule Part:	RSS-247, Issue 2, 2017 RSS-GEN Issue 5 Amendment 2, 2021
KDB:	558074 D01 15.247 Meas Guidance v05r02 Guidance for Compliance Measurements on Digital Transmission Systems, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under §15.247 of the FCC rules (April 2, 2019)

- *partial testing, see test suite for details*

Date:	5 November 2021	Date:	5 November 2021
Issued by:		Checked by:	
	Pekka Kälviäinen Testing Engineer		Mikko Halonen Development Engineer

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GENERAL REMARKS

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

RELEASE HISTORY

Version	Changes	Issued
1.0	Initial release	12 October 2021
1.1	Product description updated (EUT2 serial number). Test results for Maximum Peak Conducted Output Power updated. Measurement uncertainty for Maximum Peak Conducted Output Power corrected.	5 November 2021

PRODUCT DESCRIPTION

Equipment Under Test

Equipment Under Test:	Varjo VR-3 Mixed Reality Headset
Model/type:	PMN: VR-3 HVIN: HS-6
Serial no:	EUT1: V0022CC15AE1200008 EUT2: V0022D309AP1200019 (temporary antenna connectors)
FCC ID:	2AROD-004
IC:	24483-004
Headset	-
AC Adapters (two units)	ATS036T-W120V, input 100-240V 50/50Hz, output: 12VDC
HMD to VR adapters (two units)	R-RBZL-KSC001H
Computer	RAZER, Product N. RZ09-03305N43, s/n: BY2020M01001452

General Description

The VR-3 is a photorealistic Virtual reality headset. The headset has forward hand tracking IR cameras and two internal proprietary radio transmitters, with integral antennas, operating at 2.4 GHz. The headset is powered by 12 V DC from two pre-approved power supplies. The power supplies power two VR-adapter units which in turn interface with a control PC and the headset via USB.

Classification

Fixed device	☐
Mobile Device (Human body distance > 20cm)	☐
Portable Device (Human body distance < 20cm)	☒

Modifications Incorporated in the EUT

EUT1: No modifications.

EUT2: Temporary antenna connectors, special software to operate radios

Ratings and declarations

Operating Frequency Range (OFR):	2402 - 2480 MHz
Channels:	40
Channel separation:	2 MHz
Transmission technique:	DSSS
Modulation:	GFSK
Antenna type:	Integral Manufacturer: PulseLarsen Antennas Type: W3008 featuring 2400-2483.5MHz.
Integral Antenna gain:	1.1 dBi

Power Supply

Operating voltage range:	100 -240 V, 50 – 60 Hz mains supply

Mechanical Size of the EUT

Height: 200 mm	Width: 290 mm	Length: 170 mm

Cables

from	to	type	length (m)
EUT (CNTX)	HMD to VR adapter 1	USB-C	5.0
HMD to VR adapter 1	Computer, USB A	USB-A	1.0
HMD to VR adapter 1	Computer, USB-C	Display port + USB-C adapter	1.0 + 0.2
HMD to VR adapter 1	AC Adapter 1	two wires	1.5
AC Adapter 1	AC mains	two wires	1.0
EUT (FOCUS)	HMD to VR adapter 2	USB-C	5.0
HMD to VR adapter 2	Computer, USB A	USB-A	1.0
HMD to VR adapter 2	Computer, USB-C	Display port + USB-C adapter	1.0 + 0.2
HMD to VR adapter 2	AC Adapter 1	two wires	1.5
AC Adapter 1	AC mains	two wires	1.0
EUT	Headset	audio cables	0.65
Computer	Power supply	3 wires	2.0
Power supply	AC mains	3 wires	1.0

SUMMARY OF TESTING

Test Specification	Description of Test	Result
§15.203	Antenna requirement	**PASS**
§15.207(a) / RSS-GEN 8.8	Conducted Emissions on Power Supply Lines	**PASS**
§15.247(b)(3) / RSS-247 5.4(d)	Maximum Peak Conducted Output Power	**PASS**
§15.247(a)(2) / RSS-247 5.2(a)	6 dB Bandwidth	**N/T**[1)]
§15.247(e) / RSS-247 5.2(b)	Power Spectral Density	**N/T**[1)]
RSS-GEN 6.7	99% Occupied Bandwidth	**N/T**[1)]
§15.247(d) / RSS-247 5.5	100 kHz Bandwidth of Frequency Band Edges and Conducted Spurious Emissions	**N/T**[1)]
§15.209(a), §15.247(d) / RSS-247 5.5	Radiated Emissions Within the Restricted Bands	**N/T**[1)]

1) Not tested by the request of the customer

The decision rule applied for the tests results stated in this test report is according to the requirements of section 1.3 of ANSI C63.10-2013.

EUT Test Conditions during Testing

The EUT was in continuous transmit mode during all the tests. The hopping was stopped and the EUT was configured into the wanted channel using software provided by the manufacturer.

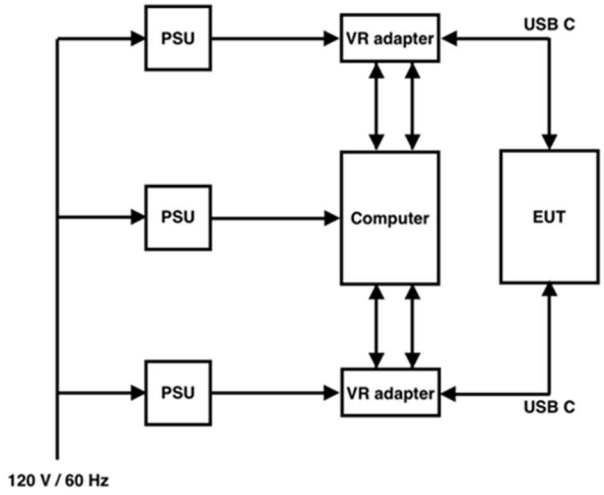

Figure 1: Test setup block diagram

Table 1: Test frequencies

Channel	Frequency (MHz)
Low	2402
Mid	2440
High	2480

Test Facility

Testing Laboratory / address: FCC designation number: **FI0002** ISED CAB identifier: **T004**	SGS Fimko Ltd Takomotie 8 FI-00380, HELSINKI FINLAND
Test Site:	☐ K10LAB, ISED Canada registration number: **8708A-1** ☒ K5LAB, ISED Canada registration number: **8708A-2** ☐ T10LAB

TEST RESULTS

Antenna requirement

Standard: FCC Rule §15.203
Tested by: PKA
Date: 8 October 2021

FCC Rule: 15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Specification	Requirement (at least one of the following shall be applied)	Conclusion
§15.203	1. Permanently attached antenna 2. Unique coupling to the intentional radiator 3. Professionally installed radio. The installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.	PASS
Note	Option 1 is used	

Conducted Emissions In The Frequency Range 150 kHz - 30 MHz

Standard:	ANSI C63.10	(2013)
Tested by:	PKA	
Date:	8 October 2021	
Temperature:	23°C	
Humidity:	42 % RH	
Barometric pressure:	1036 hPa	
Measurement uncertainty:	± 2.9 dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.207 (a)
RSS-GEN 8.8

Conducted disturbance voltage was measured with an artificial main network from 150 kHz to 30 MHz with a resolution bandwidth of 9 kHz. Measurements were carried out with peak and average detectors.

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

Results:

AC power port for "CNTX", EUT1

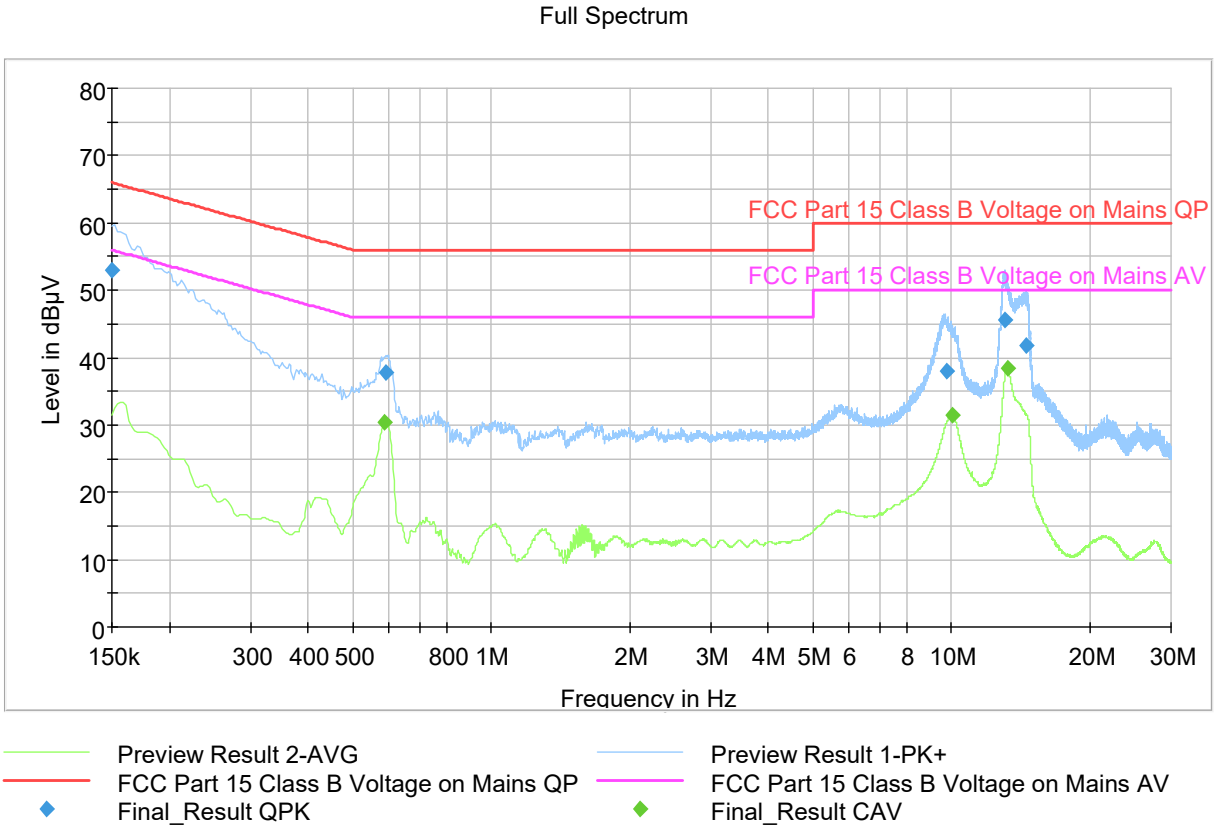

Figure 2: The measured curves with peak- and average detector

Final measurements from the worst frequencies

Table 2: Final QuasiPeak and Average measurements from the worst frequencies

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.150000	52.91	---	66.00	13.09	1000.0	9.000	N	9.7
0.586000	---	30.46	46.00	15.54	1000.0	9.000	N	9.7
0.590000	37.84	---	56.00	18.16	1000.0	9.000	N	9.7
9.738500	37.89	---	60.00	22.11	1000.0	9.000	L1	10.2
10.045000	---	31.35	50.00	18.65	1000.0	9.000	L1	10.3
13.097500	45.69	---	60.00	14.31	1000.0	9.000	L1	10.3
13.241000	---	38.37	50.00	11.63	1000.0	9.000	L1	10.3
14.569500	41.69	---	60.00	18.31	1000.0	9.000	L1	10.4

The correction factor in the final result table contains the sum of the transducers (transient limiter + cables). The result value is the measured value corrected with the correction factor.

AC power port for "FOCUS", EUT1

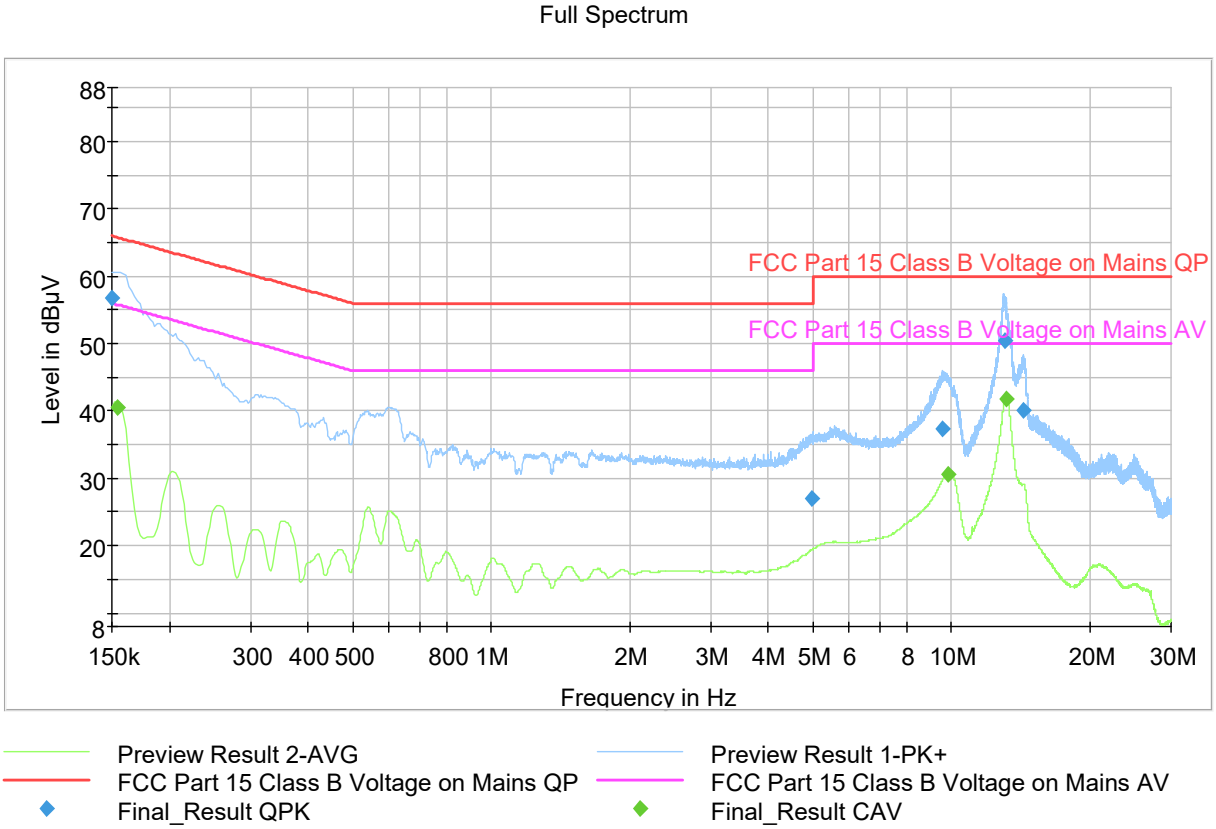

Figure 3: The measured curves with peak- and average detector

Final measurements from the worst frequencies

Table 3: Final QuasiPeak and Average measurements from the worst frequencies

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.150000	56.80	---	66.00	9.20	1000.0	9.000	N	9.7
0.154000	---	40.44	55.78	15.34	1000.0	9.000	N	9.7
4.963500	26.94	---	56.00	29.06	1000.0	9.000	L1	10.0
9.533250	37.33	---	60.00	22.67	1000.0	9.000	N	10.2
9.857250	---	30.68	50.00	19.32	1000.0	9.000	N	10.3
13.048750	50.35	---	60.00	9.65	1000.0	9.000	N	10.4
13.149000	---	41.87	50.00	8.13	1000.0	9.000	N	10.4
14.355250	40.08	---	60.00	19.92	1000.0	9.000	N	10.4

The correction factor in the final result table contains the sum of the transducers (transient limiter + cables). The result value is the measured value corrected with the correction factor.

Maximum Peak Conducted Output Power

Standard:	ANSI C63.10	(2013)
Tested by:	HEM	
Date:	4 November 2021	
Temperature:	22 °C	
Humidity:	39 % RH	
Barometric pressure:	995 hPa	
Measurement uncertainty:	± 0.49 dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(b)(3)
RSS-247 5.4(d)

For systems using digital modulation in the 2400-2483.5 MHz bands the limit is 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power.

Measured values are peak values.

Results:

Table 4: Maximum conducted output power

Channel	Left Antenna [dBm]	Right Antenna [dBm]	Left Antenna [W]	Right Antenna [W]	Sum [W]	Limit [W]	Result
Low	-0.1	-0.1	0.00098	0.00098	0.00195	1	PASS
Mid	-0.9	-0.7	0.00081	0.00085	0.00166	1	PASS
High	-1.2	-1.4	0.00076	0.00072	0.00148	1	PASS

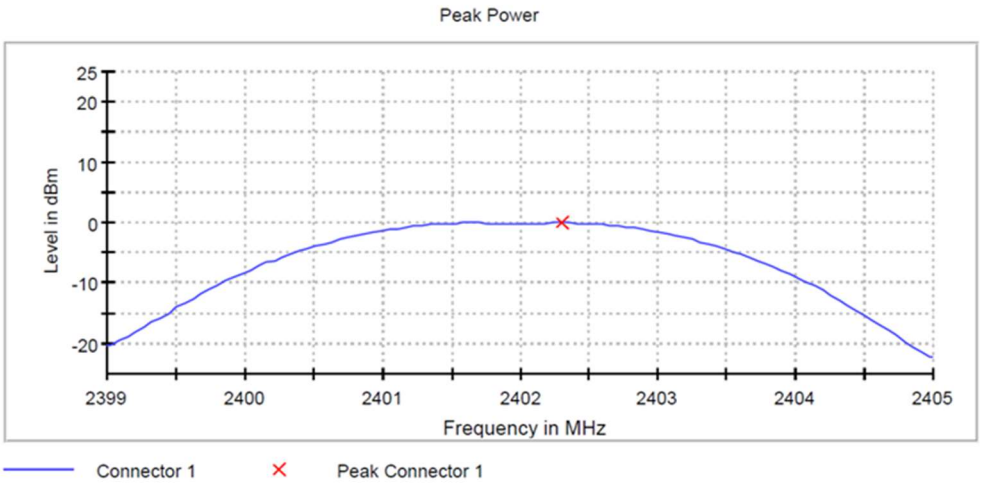

Figure 4: Conducted power, Channel LOW (left antenna)

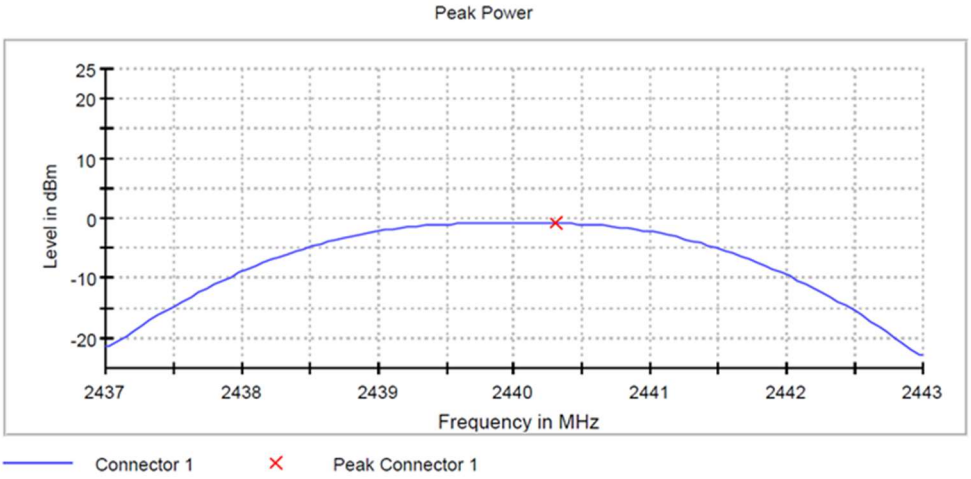

Figure 5: Conducted power, Channel MID (left antenna)

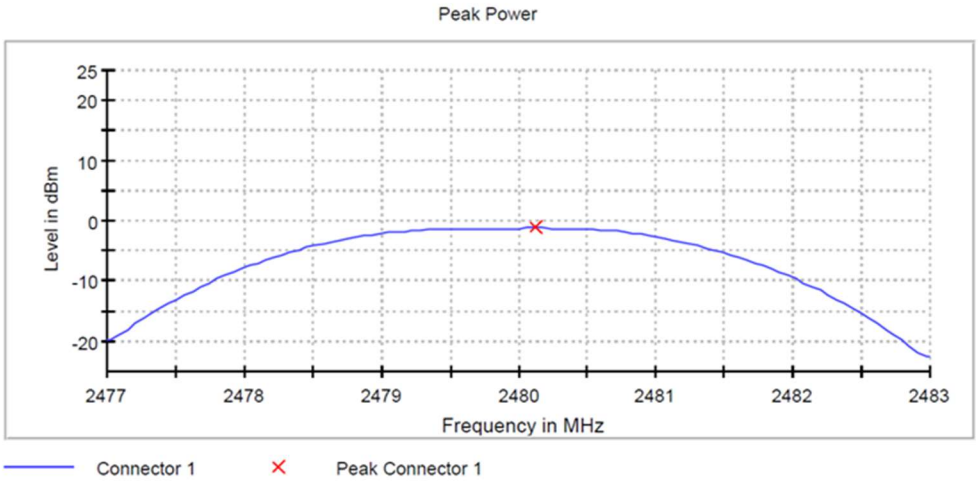

Figure 6: Conducted power, Channel HIGH (left antenna)

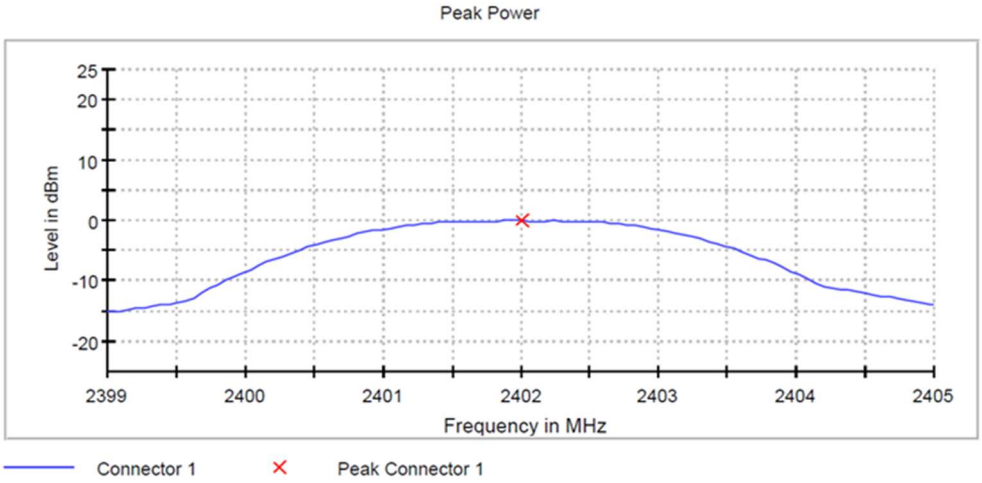

Figure 7: Conducted power, Channel LOW (right antenna)

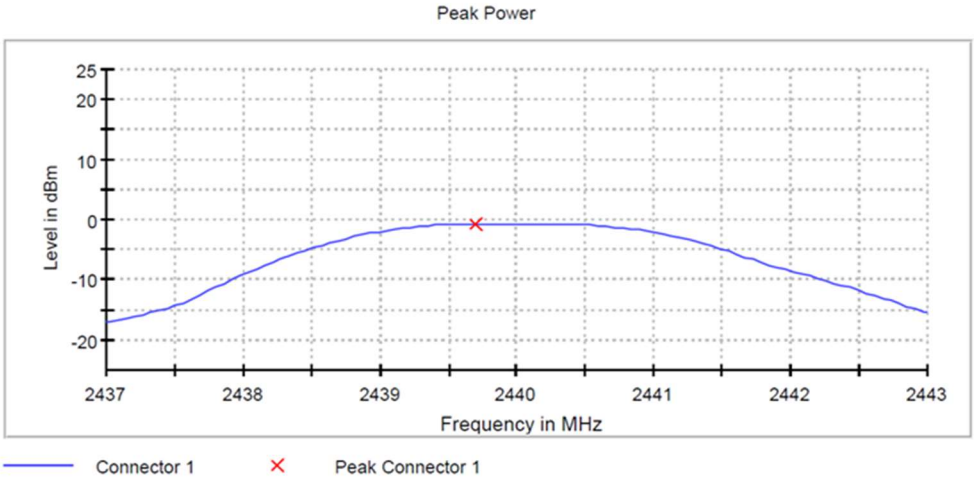

Figure 8: Conducted power, Channel MID (right antenna)

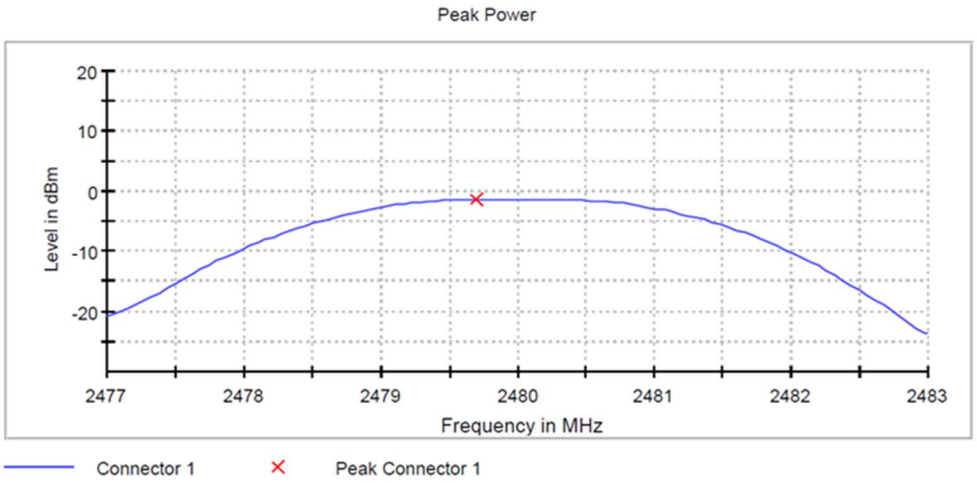

Figure 9: Conducted power, Channel HIGH (right antenna)

TEST EQUIPMENT

RF-Test Equipment

Equipment	Manufacturer	Type	Inv or serial	Prev Calib	Next Calib
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	NCR	NCR
LISN	ROHDE & SCHWARZ	ENV216	inv:9611	2021-02-26	2022-02-26
LISN	ROHDE & SCHWARZ	ESH3-Z5	inv:8019	2021-05-26	2022-05-26
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW26	inv:10679	2021-06-21	2022-06-21
SPECTRUM ANALYZER	ROHDE & SCHWARZ	FSV40	inv:9093	2020-12-04	2021-12-04
ATTENUATOR	INMET	10 dB, DC-40 GHz	inv:10347	2021-04-20	2023-04-20

NCR = No calibration required

END OF REPORT